

Robert V. Duncan, Ph.D.

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Born in St. Joseph, Missouri on November 15, 1959

Education

- Ph.D.** Physics, University of California, Santa Barbara (UCSB), 1988
Thesis: *Development of Toroidal Magnetic Thermometry to Study New Phenomena Associated with the Superfluid Transition in Liquid ^4He*
Advisor: Professor Guenter Ahlers
- B.S.** Physics, Massachusetts Institute of Technology (MIT), 1982
Thesis: *Study of Energy Transfer Processes in Methyl Alcohol Using A Computer-Controlled IR-IR Double-Resonance Spectrometer*
Advisors: Professor Michael Feld and Dr. Ramchandra Dasari

Honors and Major Professional Activities

Founding Director, New Mexico Consortium's Institute for Advanced Studies at Los Alamos National Lab (2006 – date)
Fellow (and Life Member) of The American Physical Society
Gordon and Betty Moore Distinguished Scholar, Caltech (2004 – 2005)
International Steering Committee for Quantum Fluids and Solids (2003 – 2008, Committee Chair in 2004, Symposium Chair in 2003)
Chair, *Instrumentation and Measurement Topical Group*, American Physical Society (2002)
Chair, Unified Science and Technology for Biothreat Reduction Conference Series (BTR'01, BTR'02, BTR'03, BTR'04, BTR'05)
NASA Flight Principal Investigator, *Critical Dynamics in Microgravity* (1992 – 2006)

Academic Experience

2002 – 2006 Associate Dean for Research, College of Arts and Sciences, UNM
2001 – date Professor of Physics and Astronomy, UNM
2000 – date Joint Associate Professor of Electrical and Computer Engineering (ECE), UNM
1998 - date Visiting Associate in Physics, Caltech Faculty
1996 - 2001 Associate Professor of Physics, UNM
1983 – 1984 Head Teaching Assistant, Department of Physics, UCSB
1981 – 1982 Member of the MIT Committee on Educational Policy

I have taught throughout the UNM physics curriculum, including the introductory sequence of university physics, introduction to relativity and to quantum physics, graduate condensed matter physics, graduate electromagnetism, interdisciplinary courses in self-organized criticality and in biological physics, and senior laboratory. I am now leading the development of our new core curriculum in “Chemistry and Physics at the Nanoscale”, which was team taught beginning in 2006. I have advised many post-docs, graduate students, and undergraduate students, primarily at UNM, and more recently at Caltech. Many of my former students now hold permanent positions in academia, industry, and in the national laboratories.

Industrial Experience

1981 - date Consultant to numerous high-technology and medical instrumentation companies.
1995-1996 Distinguished Member of Technical Staff, Sandia National Laboratories (SNL)
1994-1996 Leader, Cryogenic and Superconducting Technologies Team, SNL
1988-1995 Member (later Senior Member) of Technical Staff, SNL
1988-1989 Visiting Scientist, Electricity Division, National Institute of Standards and Technology (formerly the National Bureau of Standards)

Patents

US. Patent No. 5,193,909, "Quantitative Method for Measuring Heat Flux Emitted from a Cryogenic Object", issued 3/16/93 to Robert V. Duncan; assigned to the US Government.
Three other patent applications filed or pending.

Refereed Publications in Journals, Books, and Book Chapters

1. "Singularity in the Kapitza Resistance between Gold and Superfluid ^4He " with Guenter Ahlers and Victor Steinberg, *Phys. Rev. Lett.* **58**, 377 (1987).
2. "Nonlinearity in the Kapitza Resistance Between Gold and Superfluid ^4He Near T_λ ", with G. Ahlers, *Jpn. J. Appl. Phys.* **26-3**, 363 (1987).
3. "Depression of the Superfluid Transition in ^4He by a Heat Current" with Guenter Ahlers and Victor Steinberg, *Phys. Rev. Lett.* **60**, 1522 (1988).
4. "Finite-Size Effects on the Thermal Conductivity of ^4He Near the Superfluid Transition" with Guenter Ahlers, *Phys. Rev. Lett.* **61**, 846 (1988).
5. "Recent Experiments near the Superfluid Transition in ^4He " with Guenter Ahlers, in Frontiers of Physics, Proceedings of the Landau Memorial Conference, E. Gotsman, Y. Ne'eman, and A. Voronel (eds.), p.219 (Oxford : Pergamon Press 1990).
6. "Thermal effects on the Josephson series-array voltage standard", *Physica B* **165-166**, 101 (1990).
7. "Singularity and Nonlinearity in the Kapitza Resistance Between Gold and Superfluid ^4He ", with G. Ahlers, *Phys. Rev. B* **43**, 7707 (1991).
8. "Using a New Generation of Multimeters to Measure the Quantized Resistance" with M.E. Cage, D.Y. Yu, B.M. Jeckelmann, and R.L. Steiner, *IEEE Transactions on Instruments and Measurements* **40**, 262 (1991).
9. "A Refrigerated Dewar for the Josephson Array Voltage Calibration System" *IEEE Transactions on Instrumentation and Measurement* **40**, 326 (1991).
10. "Measurement accuracy of macroscopic quantum circuits with rf-biased Josephson junction arrays" with D. H. Dunlap, *Superconductor Science and Technology* **4**, 413 (1991).
11. "Proposed differential frequency readout system by hysteretic Josephson junctions" with L. Z. Wang, *Phys. Rev. A* **46**, 3617 (1992).
12. "Superconducting Instrumentation for Precision Measurement and Control", in Superconducting Devices and Their Applications, page 446, H. Koch and H. Lubbig, editors (Springer-Verlag, Berlin, 1992).
13. "Fundamental Measurement Accuracy of RF-Biased Josephson Device Comparisons" with D. H. Dunlap, *J. Appl. Phys.* **71**, 6177 (1992).

14. "A Superfluid-Transition Fixed-Point Temperature-Reference" with G. Ahlers, in Temperature : Its Control and Measurement in Science and Industry, Volume 6, page 243, J. F. Schooley, editor (American Institute of Physics Press, New York, 1992).
15. "A frequency to voltage converter based on Bloch oscillations in a capacitively-coupled GaAs-GaAlAs quantum well" with D. Dunlap, V. Kovanis, and J. Simmons, *Phys. Rev. B* **48**, 7975 (1993).
16. "Quantitative Method for Measuring Heat Flux Emitted from a Cryogenic Object", U.S. Patent No. 5,193,909, issued March 16, 1993.
17. "Dynamic measurements near the lambda-point in a low-gravity simulator on the ground" with U.E. Israelsson, D.M. Strayer, T.C.P. Chui, and M. Larson, *Physica B* **194-196**, 593 (1994).
18. "Sidewall thermometry perturbations to nonlinear heat transport near the superfluid transition" with R. Akau, S. Gianoulakis, U.E. Israelsson, and T.C.P. Chui, *Physica B* **194-196**, 603 (1994).
19. "Effect of Gravity on the Thermal-Conductivity Measurement of ^4He near T_λ ", with F-C. Liu, U. E. Israelsson, T.C.P. Chui, D. Hensinger, A. Nash, M.J. Adriaans, W.A. Moeur, *Czechoslovak Journal Of Physics* **46(S1)**, 87 (1996).
20. "Cryogenic Design Of The Liquid-Helium Experiment Critical-Dynamics In Microgravity" with M.J. Adriaans, W. A. Moeur, S.T.P. Boyd, and D. M. Strayer, *Cryogenics* **36**, 787 (1996).
21. "Critical-Dynamics In Microgravity" with S.T.P. Boyd, W.A. Moeur, S. Robinson, R. Akau, and S. Gianoulakis, *International Journal Of Thermophysics* **17**, 631 (1996).
22. "Observation of Self-Organized Criticality Near the Superfluid Transition in ^4He ", with W.A. Moeur, P.K. Day, F-C. Liu, S.T.P. Boyd, and M.J. Adriaans, *Phys. Rev. Lett.* **78**, 2421 (1997).
23. "Large Enhancement of Boron Carbide's Seebeck Coefficients through Vibrational Softening", with T. L. Aselage, D. Emin, and S. S. McCready, *Phys. Rev. Lett.* **81**, 2316 (1998).
24. "Breakdown of Fourier's Law near the Superfluid Transition in ^4He ", with P. K. Day, W. A. Moeur, S. McCready, D. Sergatskov, and F-C. Liu, *Phys. Rev. Lett.* **81**, 2474 (1998).
25. "Gravitational Effects on Nonlinear Heat Transport near the Superfluid Transition in ^4He ", with P. K. Day, S. McCready W. A. Moeur, F-C. Liu, and D. Sergatskov, *J. Low Temp. Phys.* **113**, 861 (1998).
26. "PdMn and PdFe: New Materials for Temperature Measurement Near 2K", with B. Klemme, M.J. Adriaans, P.K. Day, D.A. Sergatskov, and T.L. Aselage, *J. Low Temp. Phys.* **116**, 133 (1999).
27. "Onset of superfluidity far from equilibrium: dynamical effects on the correlation length", with D. Sergatskov, S. Boyd, T. McCarson, A. Babkin, P. Day, and D. Elliott, *Physica B* **280**, 45 (2000).
28. "Dynamic and Gravitational Effects on the Correlation Volume: Experimental Methods" with D.A. Sergatskov, S.T.P. Boyd, S.S. McCready, T.D. McCarson, A.V. Babkin, P.K. Day, F-C. Liu, and D. Elliott, *J. Low Temp. Phys.* **119**, 265 (2000).
29. Science Requirements Document for Critical Dynamics in Microgravity, JPL Document Number D-18698, May 31, 2000.
30. "Gravitational alignment in ground-based measurements to support Critical Dynamics in Microgravity" with Sven Mueller, T. D. McCarson, and D. A. Sergatskov, *AIP Conference Proceedings* **504**, 701 (2000).

31. "The CQ Experiment", with T.C.P. Chui, A.H Harter, R.A.M. Lee, A. Chatto, P.K. Day, and D.L. Goodstein, American Institute of Aeronautics and Astronautics, **AIAA 2001-4964** (2001).
32. "Critical Dynamics in Microgravity - Flight prototype and planned orbital measurements", with D. Sergatskov, S. Boyd, A. Babkin, T. McCarsen and P. Day, American Institute of Aeronautics and Astronautics **AIAA-2001-4936** (2001).
33. "Sampled DC technique for high precision resistance measurements" with P. R. Williamson, J. A. Lipa, and D. A. Sergatskov, American Institute of Aeronautics and Astronautics **AIAA-2001-4937** (2001).
34. "Numerical Analysis of a Cryogenic Bolometer for Space Radiation Measurement" with S.T.P. Boyd, W.A. Holmes, and P.R. Williamson, American Institute of Aeronautics and Astronautics **AIAA-2001-4969** (2001).
35. "New Measurement Technology for DYNAMX, and for Future Fundamental Physics Missions in Space" with D. A. Sergatskov, A. V. Babkin, S.T.P. Boyd, R. C. Nelson, P. K. Day, J. Dooley, and D. Elliott, FP-1067, *Proc. 2nd Pan Pacific Basin Workshop on Microgravity Science* (2001).
36. "The CQ Experiment: Enhanced Heat Capacity of Superfluid Helium in a Heat Flux", with D. L. Goodstein, A. W. Harter, R. A. M. Lee, A. Chatto, T. C. P. Chui, and P. Day, FP-1025, *Proc. 2nd Pan Pacific Basin Workshop on Microgravity Science* (2001).
37. "New Paramagnetic Susceptibility Thermometers for Fundamental Physics Measurements" with D. A. Sergatskov, P. K. Day, A. V. Babkin, R. C. Nelson, T. D. McCarsen, and S.T.P. Boyd, in *Temperature : Its Control and Measurement in Science and Industry*, 7, 1009, Dean C. Ripple, editor (American Institute of Physics Press, New York, 2002).
38. "Self-Organized Heat Transport near the Superfluid Transition in ⁴He" with D.L. Goodstein, A.V. Babkin, and D.A. Sergatskov, *J. Low Temp. Phys.* **126**, 1529 (2002).
39. Proceedings of the 2002 Conference on Unified Science and Technology for Reducing Biological Threats and Countering Terrorism (BTR 2002), R. V. Duncan, Chair, University of New Mexico
40. "The Magnetic Properties of Sputtered Pd_{1-x}Mn_x Films for Thermometry and Bolometry", with R.C. Nelson and D.A. Sergatskov, *J. Low Temp. Phys.* **127**, 173 (2002).
41. "The CQ Experiment: Enhanced Heat Capacity of Superfluid Helium in a Heat Flux", with R. A. M. Lee, A. W. Harter, A. Chatto, T. C. P. Chui, P. K. Day and D. L. Goodstein, Paper-2.0103, 2002 IEEE Aerospace Conference, 1-31 (2002).
42. "Ultrasound Imaging of Breast Tissue" with N. Duric, P. Littrup, E. Holsapple, A. Babkin, A. Kalinin, A. Pevzner, and A. Tokarev, *Proceedings of the SPIE: Medical Imaging 2003*; San Diego, California; Feb. 21-26, 2003. Ultrasonic Imaging and Signal Processing – Paper 5035-4.
43. "New Propagating Mode Near the Superfluid Transition in ⁴He", with D.A. Sergatskov, A.V. Babkin, R.A.M. Lee, and S.T.P. Boyd, *Physica B* **329 – 333**, 208 (2003).
44. "New Paramagnetic Susceptibility Thermometers for Fundamental Physics Measurements" with D.A. Sergatskov, P.K. Day, A.V. Babkin, R.C. Nelson, T.D. McCarsen, and S.T.P. Boyd, AIP Conference Proceedings 684, 1009 (2003).
45. Proceedings of the 2003 Conference on Unified Science and Technology for Reducing Biological Threats and Countering Terrorism (BTR 2003), R. V. Duncan, Chair, University of New Mexico
46. "'Heat from Above' heat capacity measurements in liquid ⁴He", with R.A.M. Lee, A. Chatto, D.A. Sergatskov, A.V. Babkin, S.T.P. Boyd, A.M. Churilov, T.D. McCarsen, T.C.P. Chui, P.K. Day, and D.L. Goodstein, *J. Low Temp. Phys.* **134**, 495 (2004).

47. "Preface to the Proceedings of QFS 2003" with S.T.P. Boyd and D. L. Goodstein, *J. Low Temp. Phys.* 134, 1 (2004); "Welcome Address to QFS 2003, delivered by Louis Caldera, President of UNM", *J. Low Temp. Phys.* 134, 17 (2004).
48. "Experiments in ^4He Heated From Above, Very Near the Lambda Point", with D.A. Sergatskov, A.V. Babkin, S.T.P. Boyd, and R.A.M. Lee, *J. Low Temp. Phys.* 134, 517 (2004).
49. "Experiments in Fundamental Physics Scheduled and in Development for the ISS" with C. Lammerzahl, G. Ahlers, N. Ashby, M. Barmatz, P. Beirmann, H. Dittus, V. Dohm, K. Gibble, J. Lipa, N. Lockerbie, N. Mulders, and C. Salomon, *General Relativity and Gravitation* 36, 615 (2004).
50. "Fundamental Physics: Long-range quantum order, interactions, and phase transitions" (Preface), *Advances in Space Research*, Elsevier, (2004).
51. Proceedings of the 2004 Conference on Unified Science and Technology for Reducing Biological Threats and Countering Terrorism (BTR 2004), R. V. Duncan, Chair, University of New Mexico.
52. "Demonstration of an Ultra-Stable Temperature Platform" with C. J. Green and D. A. Sergatskov, *J. Low Temp. Phys.* 138, 871 (2005).
53. "Adaptive Optimal PI Controller for Use in Precision Low-Temperature Experiments" with Jinyang Liu and D. A. Sergatskov, *J. Low Temp. Phys.* 138, 905 (2005).
54. "Dynamic Simulation of the Superfluid / Normal Fluid Interface Motion in ^4He " with Z. Xie, N. C. Menicucci, S.T.P. Boyd, and D. A. Sergatskov, *J. Low Temp. Phys.* 138, 79 (2005).
55. Proceedings of the 2005 Conference on Unified Science and Technology for Reducing Biological Threats and Countering Terrorism (BTR 2005), R. V. Duncan, Chair, University of New Mexico.
56. "CW Measurements of the Upward-Going Temperature Wave in the ^4He Self-Organized Critical State" with S.T.P. Boyd and D.A. Sergatskov, AIP Conference Proceedings, LT24, accepted for publication (2006).
57. "Effect of Inhomogeneous Heat Flow on the Enhancement of the Heat Capacity in He-II by Counterflow near T_λ ", with S.T.P. Boyd, A. Chatto, R.A.M. Lee, and D. Goodstein, AIP Conference Proceedings, LT24, accepted for publication (2006).
58. "Magnetic Properties of Pd(96%)Mn(4%) Films for High Resolution Thermometry" with R. C. Nelson, C. Green, and D.A. Sergatskov, AIP Conference Proceedings, LT24, accepted for publication (2006).
59. "Measurements of the SOC State Heat Capacity in 4He " with A. Chatto, R.A.M. Lee, P.K. Day, and D. Goodstein, AIP Conference Proceedings, LT24, accepted for publication (2006).
60. "Critical Phenomena Measurements in Space: Past, Present, and Future", with Martin Barmatz, Inseob Hahn, and John Lipa, accepted for publication in *Reviews of Modern Physics* (2006).

I am a co-author on manuscripts in progress for the Journal of Low Temperature Physics detailing work that were presented at the International Symposium of Quantum Fluids and Solids in Kyoto in August, 2006 (two invited papers and two contributed papers). I am also a co-author on two drafts in progress for Physical Review Letters, on a draft concerning the growth and characterization of magnetic semiconductors, and on three manuscripts regarding new techniques and devices for medical instrumentation. I am actively involved in on-going research through my faculty positions at both Caltech and UNM.

Invited Talks and Presentations

Over fifty published abstracts, internal reports, and non-refereed publications.

Invited Presentation to the International Symposium on Quantum Fluids and Solids, (Kyoto, Japan, 2006).

Invited presentation to the Fourth Annual "Pushing the Envelope: Medicine in Extreme Environments" conference at the University of Texas, Medical Branch in February, 2004.

Invited presentation to the International Symposium on Quantum Fluids and Solids (Minnesota, USA, 2000).

Two invited presentations to The American Physical Society's March Meeting (1987 and 2000)

Invited presentation at the 22nd International Conference on Low-Temperature Physics (Helsinki, Finland, 1999)

Six other plenary or invited presentations at international conferences.

Delivered invited Physics Symposium Presentations or Condensed Matter Physics Seminars at Caltech, Stanford, University of Texas (El Paso), University of California (Santa Barbara), State University of New York (Buffalo), Los Alamos National Laboratory, Sandia National Laboratories, Air Force Research Labs, and the University of New Mexico.

Professional Society Service

Fellow, and Life Member, The American Physical Society (APS)

Executive Committee, APS Instrumentation and Measurement Topical Group (IMSTG), 1998 - 2002

Vice Chair, IMSTG, 1999

Chair of the APS Fellowship Nomination Committee of the IMSTG, 1999

Chair, IMSTG, 2001-2002

Referee for the NSF, Physical Review Letters, and the Journal of Low Temperature Physics

Membership on two federal 'Blue Ribbon' review committees (past).

UNM Service

Chair, UNM Conflict of Interest Committee

Coordinator of the Joint Science and Technology Laboratory (JSTL) research grant award program between UNM and LANL in 2005 and 2006.

Member of the UNM Research Cabinet

Member of the UNM Business and Economic Development Council

Member of the UNM Information Technology Cabinet (representing the Provost)

Interim Chair of the Committee for Undergraduate Research (I started UNM's Program of Research Opportunities for Undergraduates (PROFOUND) in collaboration with the Provost).

Member of the UNM Committee for Cross Campus Collaborations in the Life Sciences (first research awards in this program were announced on December 8, 2005)

Chair of the UNM Athletic Council (past)

Member, Physics and Astronomy Department Committees, including the Colloquium Committee (chair), Undergraduate Committee, Ad-Hoc Committee on Graduate Student Recruitment (past)

Member of many Ph.D. committees, and a reviewer for Tenure and Promotion considerations within the College of Arts and Sciences

Other Activities

Ultra-Marathon Runner, two finishes in the Leadville 100-Mile Mountain Run (1996, 1999).

Former Assistant Scoutmaster of a troop serving learning disabled scouts.

Former Private Pilot, with over 250 hours of total flight time

Former Director of Wilderness Survival Training, Boy Scouts of America, Pony Express Council

Former Youth President of the National Eagle Scout Association, Pony Express Council
Winner in the 1978 Westinghouse Science Talent Search ('Top 40')
Eagle Scout (1976)